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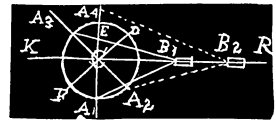
182. Proposed by A. H. HOLMES, Brunswick, Maine.

Evaluate $\int_0^{\frac{1}{2}\pi} d\theta \sqrt{[1+\sin^2\theta(1-4\cos\theta)]}$.

MECHANICS.

170. Proposed by ELISHA S. LOOMIS, Berea, Ohio.

Two angles of iron, A_1CD and A_1CA_3, move freely on a pivot at C. Rods B_1A_1 and B_1A_3 are attached respectively at A_1 and at some point A_3 so that when B_1 moves along the rod CR, which is perpendicular to A_1A_4, CD and CA_3 shall coincide in position with CE which is perpendicular to rod KR. When angle A_1CD is 135° find CA_3 in terms of CA_1.



Also find the following:

1. That value of CB_1 which will require least effort exerted at B_1 to cause CA_3 to take the position CA_4.

2. That value of CB_1 which will cause B_2A_2, if produced, to pass through the point A_1.

3. As CB_1 varies in value, what is the locus of the intersection of A_1B_1 and A_2B_2? Of B_1A_3 and B_2A_4?

4. Suppose angle A_1CD to be any other angle than 135°, then find CA_3 in terms of CA_1.

GROUP THEORY.

5. Proposed by L. E. DICKSON, Ph. D., The University of Chicago.

In lieu of the incorrect developments of Burnside, *Theory of Groups*, pp. 56-58, show that an Abelian group of type $(m_1, m_2, \ldots\ldots, m_r)$, $m_1 \geqq m_2 \geqq \ldots\ldots \geqq m_r$, has a subgroup of type $(n_1, n_2, \ldots\ldots, n_s)$, $n_1 \geqq n_2 \geqq \ldots\ldots \geqq n_s$, if and only if $s \leqq r$, $n_i \leqq m_i$ $(i=1, \ldots\ldots, s)$.

MISCELLANEOUS.

145. Proposed by H. F. MacNEISH, Chicago, Ill.

Two complete 5-plane configurations in space having the same vertices are identical; in general two complete $(n+2)$-faces in n-space having the same vertices are identical.

NOTES.

Dr. H. L. Rietz has been promoted to an assistant professorship at the University of Illinois.